



MURRAH RIVER RESIDENCE DECATHAROOS

University of Technology Sydney [New Housing] [April 05, 2022]



Render: North East view from Verandah

Project Summary

UTS Decatharoos propose a flexible, passive house design for the unique landscape and climatic conditions that exist on the South Coast of New South Wales, Australia. The house is designed to be bushfire resistant and energy and water independent so that it can be deployed on any typical site in the country whether in remote rural or suburban areas.

The innovative design is flexible in many ways: performance, structural system, integrated services, spatial planning, life cycle, bushfire response, siting, occupant experience, and response to nature. Energy independence, bushfire independence, and passive heating and cooling for thermal comfort independence are critical features. We define 'independent living' to mean off the grid but also to mean the occupants can control their environment. The house can grow over time to accommodate people's changing needs in different stages of life.

In addition, we envision a house that is part of a larger community response to the bushfire threat; it will be equipped with a suite of sensors so that it can act as a data collector for fire warning and monitoring. The house can also double as a fire response staging site during emergencies – it is close to the sea and the main access road for the region plus its open site is ideal for emergency helicopter landings.

Design Strategy

The target market for the house is any Australian seeking home ownership particularly those who wish to live in the iconic Australian bush. Most Australian residents 'shutdown & leave' in the face of a bushfire, so this house is designed to be extremely well protected and resist burning when a bushfire comes through. Whilst bushfires are part of the natural cycle in Australia, climate change has made them more frequent and far more severe placing people and property at greater risk.

The house combines rammed earth construction using local clay with panels of standard dimensions assembled on a grid that minimizes waste. The house can be constructed in stages to allow for maximum flexibility over the lifetime of its occupants. The systematic approach enables an economic design that can be realised by the local community, with the supervision of local trades.

We will be designing with Country, considering Indigenous Australian practices to bush maintenance and bushfire design as well as site design in order to improve building performance.

Project Data

Location Murrah, South Coast, NSW, Australia
(a typical bushfire zone site)

Climate Zone 6

Lot Size 1 acre

Building Site 1,000ft², 1 storey

Program 3 Bed, 2 Bath, 1 Garage, Open Living

Occupancy 2 - 5 (200ft²/person)

Construction Cost \$140/ft² (including inflation)

Energy Performance 5667.93015 EUI (kBtu/ft²/yr) HERS Score 8.8, Heating 16.9 MJ/m²,

Cooling 7.8 MJ/m²

This is off grid, renewable energy only.

Average Utility Cost 266.97 \$/month

Annual Carbon Emissions 10.4 T CO₂e/ ft²/yr

Technical Specifications

R-Values (total) Corrugated roof 6.29, Green roof 3, Rammed Earth Wall 4.19, Concrete On-ground slab 3.8, Concrete Off-ground slab 2.6

Window (triple glazed) U-value & SHGC

Fixed (U) 0.95 (S) 0.28, Sliding (U) 1.20 (S) 0.37

Casement (U) 1.39 (S) 0.39

Doors Sliding (U) 1.08 (S) 0.27

On Site PV 12 kW (rooftop)

Community PV The extra power (that can't be stored) produced will be fed into the grid/ provided to on sites that can use the grid.

Backup power (in an emergency, if needed) is fed from existing solar farm & micro wind contingent on community involvement.

Partners

Industry Partners Atelier 10



U.S. DEPARTMENT
OF ENERGY
**SOLAR
DECATHLON**



Photograph: North East view from site location



Render: West view from Natural Retention Pond

Project Highlights

Architecture The house is designed to offer an appealing, comfortable and affordable home to the typical Australian family on an iconic Australian site, designed to take advantage of all the natural features of the site, suit and work with the local climate, and be durable and resilient. We have embraced the Australian modern tradition of making elegant domestic spaces using simple, straightforward means. The house has a minimal footprint in order to keep construction costs down by using as little material as possible, which is complemented by the configuration of three volumes. Its configuration also reinterprets iconic Australian bush houses by architects like Glenn Murcutt, Russell Jack, Ian Weir, and more, who typically use well-articulated but simple forms. The house uses locally sourced recycled materials wherever possible and works with the iconic Australian modernist palette of steel structure, corrugated metal, and glass in open plan. Our ethos is to build with minimal disturbance to the site as to protect the natural biodiversity of the place.

Engineering The house is designed to include performance intrinsically and engineered in a sense where every component of the envelope, layout of windows, systems selection, household equipment selection etc, all contribute to the operation of the house through passive and active systems.

Market Analysis A great Australian aspiration is to have ownership of one's home and to live within the bush. Housing affordability is a tremendous obstacle in Australia with federal and state governments sponsoring a raft of policies to improve accessibility to ownership; we hope that this staged system will allow more first-time home buyers to purchase a house since they can start small, then add on rooms as needed. The effects of the pandemic have resulted in an increased demand for regional and 'off-grid' living, demonstrating that it is possible to live comfortably further away from core cities. Our proposal is even more attractive when the current state of the for-purchase market in our area is considered: there are very few existing houses for sale.

Durability and Resilience Both resilience and durability relate to design choices about building materials, structure, building systems, and function. The greatest durability and resilience challenge to our project is fire followed by weather-related climate change such as extreme heat and drought and unusually forceful storms. We have adopted several design strategies using the four Rs, robustness, resourcefulness, recovery, redundancy and other considerations to create a resilient and durable building.

Embodied Environmental Impact The building will use recycled, non-toxic and locally sourced materials wherever possible. The standardised panel system should allow for the reuse of components making a more resilient product and producing less waste.

Integrated Performance The dwelling is oriented towards the Northeast for optimal passive solar heating; the butterfly roof is designed to capture rainwater and supplement the passive in-slab heating; built-in PVs integrated within the house will aid in energy generation; well-insulated dwelling envelope and use of thermal mass from trombe wall and floor will aid the passive heating system. The well-sealed envelope will make use of internal heat loads from occupants and equipment to negate the need for active conditioning systems.

Occupant Experience The design is focused around maximising passive systems and will also optimize surrounding panoramic views, natural light and interior-to-exterior connections to improve biophilic quality and foster wellbeing. The house will have North orientation with large windows that allow natural light to filter into the warm interiors and will come with a user manual.

Comfort and Environmental Quality The dwelling relies upon human interaction with the house to control the environment for occupancy comfort, which is naturally ventilated and controlled by operable windows. Non-toxic & low VOC materials are utilized as per international world standard, which allows the dwelling's envelope to be reactive in the event of a bushfire.

Energy Performance The house will generate more energy than needed to operate through the combination of passive and active solar. If needed, the house can utilise energy from the micro wind farm located next to the existing solar farm.